

## Planetology in the Virtual Observatory and connection to Europlanet Network

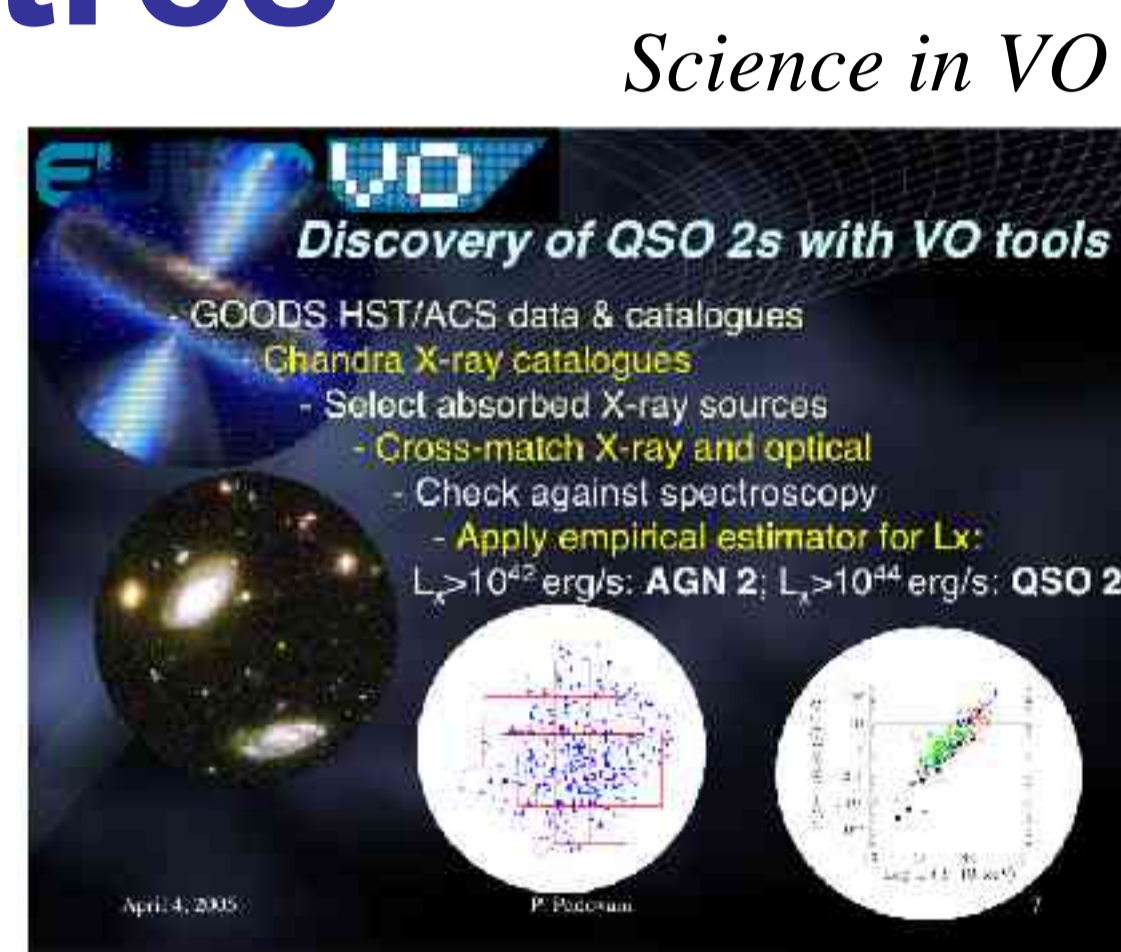
**IPSL, AIM, CDS, CESR, CNES, IAS, IAP, IMCCE, IPGP, LDTP, LISA, OBSPM, OMP, VO-France**

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## FRANCE

### Fields of Excellence, Data Centres

« an enabling and coordinating entity to foster the development of tools, protocols, and collaborations necessary to realize the full scientific potential of astronomical databases in the coming decade »  
*NVO White Paper, juin 2000*



Courtesy of **Paolo Padovani, ESO**

**CDAP:** Data Centre for Planetary Atmospheres, related to Mars-Express, Cassini-Huygens and Venus-Express missions. The web site is <http://cdap.ipsl.jussieu.fr>. Access is developed for data model and data experiments concerning atmospheric profiles of constituents and aerosol in planetary atmospheres. CDAP is part of the CNES and INSU project of national data base for space experiments related to the Solar system and planetary exploration.

**GAP:** This research team develops dynamical models, performs astrometric and physical observations and carries out analysis and interpretation to get high precision models of the motion, size and structure of various Solar system objects. Databases, ephemeris and XML web services (SkyBot project) for the VO available on IMCCE server <http://www.imcce.fr>

**CDSP:** Centre de données des surfaces planétaires is a project under study for a data base of telluric surfaces. Moon and Mars data are the priority. Multi-dimensional tools to merge data sets will be developed and presented simultaneously with the data.

**IDC:** IDC, the IAS Data Centre is designed to provide a straightforward, flexible and reliable access to a large range of datasets. Among them, planetary surfaces data acquired by remote sensing instruments (Hi-Res cameras, which give information on the geomorphology, Imaging Spectrometers which constrain the surface composition) will be delivered through a common virtual observatory structure to the community of planetary sciences.

**DGSP:** The Department of Space Research has been developing a data base in planetary geophysics. Base comprise the seismic data of Apollo missions, links to gravimetry and altimetry for Mars and the Moon, and data of spatial terrestrial magnetism. <http://ganymede.ipgp.jussieu.fr/donnees/>

**APIS:** Rings of Planets, mainly related to Cassini-Huygens and Voyager missions. The web site for information is <http://Cassini.univ-paris7.fr/>.

**FUSE:** (Far Ultraviolet Spectroscopic Explorer) is a NASA-CNES-CSA-supported astrophysics mission that was launched on June 24, 1999, to explore the Universe using the technique of spectroscopy in the far-UV. Amongst many types of objects observed with FUSE, observation of Mars, Jupiter, Saturn, Io, Titan and comets will be made accessible to the community through a "Planetology Virtual Observatory Access".

### Institute/Lab profile

**VO-France:** The French Virtual Observatory initiative, supported by INSU and CNES, cover several disciplines: astronomy, planetology, solar-terrestrial relations, astrophysics. It is a member of the International Virtual Observatory Alliance (IVOA) which is at present focused on the astronomical Virtual Observatory. The IVOA organises in particular the definition of interoperability standards for the VO. The French part of IVOA, VO-France is at CDS, Strasbourg.

**IPSL:** Institut Pierre-Simon Laplace includes SA, LMD and CETP laboratories developing space experiments and atmospheric models related to planetary atmospheres.

**LISA:** Laboratoire Inter-universitaire des Systèmes Atmosphériques develops space experiments related to planetary atmospheres.

**OBSPM:** Observatoire de Paris-Meudon-Nancay includes LESIA laboratory and the SIO-VO department. LESIA develops space experiments and atmospheric models related to planetary atmospheres and surfaces. SIO-VO department is involved in VO-France, centralising French contribution in VO-planetology (<http://vo.obspm.fr>) with IMCCE.

**IMCCE:** Institut de Mécanique céleste et de calcul des éphémérides is the laboratory of the Paris Observatory specialised in the dynamics of the Solar system objects, theoretical and applied celestial mechanics and astrometry. IMCCE is also in charge to provide the official French ephemeris. The astrometry and Planetology group of the IMCCE is strongly involved in VO.

**CESR:** Centre d'Etudes Spatiales des rayonnements develops space experiments related to planetary surfaces and environment. CESR is also in charge of the Centre de Données de la Physique des Plasma (CDPP).

**IAS:** Institut d'Astrophysique Spatiale has a long expertise in instrument design and calibration, mission control, data processing and archiving of planetary spacecrafts. Several of them (martian missions including Mars Express, Cassini-Huygens, Smart-1, ...) are currently exploring the planetary surfaces of the Solar System and will fill in the planetary surface data centre.

**IPGP:** The Paris Geophysical Institute is a research institute dedicated to the study of the earth as a system. Département de géophysique Spatiale et Planétaire has the responsibility to coordinate space activities.

**AIM:** Astrophysique et Interactions Multi-échelles research team (CEA-CNRS-Université Paris 7) is involved in the study of disk formation, dynamics and gravitational confinement. Some members of this team take an active part in the study of Saturn ring system.

**IAP:** Institut d'astrophysique de Paris has built a database of all the public dataset already accessible through SSAP (Simple Spectral Access Protocol).

### Contribution of VO-France Planetology working group

- Build a bridge between planetology and VO interoperability standards.
- Identify missing definitions for meta-data concerning dynamics, photometry and parameters related to planetary atmospheres and surfaces.
- Definition of new UCD (Unified Content Descriptors) for VO.
- Contribute to the mapping of PDS formats into VO formats defined for the astronomical Virtual Observatory.
- Develop VO-oriented tools for planetology.

### Meta data (UCD) required in VO for planetology

- [obs.atm.](#) : Generalisation and extension of 'obs.air' to planetary atmospheres
- [obs.\(elongation,phaseAng\)](#) : Solar elongation, phase angle etc...
- [pos.topo.\(alt,dist,lat,lon\)](#): Relative coordinates of a body of the solar system: Generalisation and extension of 'pos.earth'
- [pos.eop.](#) : Earth's orientation parameters

### Involvement in Europlanet

Europlanet: support for VO-Planetology  
 VO-Planetology: definition of UCDs for VO

### Hardware Facilities